

CHAPTER 1 GENERAL

1-1. Purpose.

This manual provides guidance for designing low pressure compressed air systems with a maximum design operating pressure of 125 psig. including piping, compressors, aftercoolers and separators, air receivers, and air dryers. Methods for sizing piping are included.

1-2. Scope.

The intention of this manual is to provide criteria to achieve economical, durable, efficient, and dependable compressed air systems to support Army and Air Force facilities. Where special conditions and problems are not covered in this manual, industry standards will be followed. Modifications or additions to existing systems solely for purpose of meeting criteria in this manual are not authorized. Figure 1-1 shows the arrangement of a typical compressed air system.

1-3. References.

Appendix A contains a list of references used in this document.

1-4. Energy conservation.

In selecting the type and number of compressors, the daytime, nighttime, and weekend compressed air demands of the facility must be determined. A single, large air compressor is more efficient and less costly than several smaller units if the demand is fairly constant. If the nighttime or weekend demand is considerably less than the daytime demand, however, the use of several compressors should be considered to handle the total load. At night and on weekends one unit could serve the load with the second as a standby, thereby saving energy. Other energy-saving methods include the following:

a. Compressors.

(1) Install a speed modulator to increase or decrease compressor speed according to compressed air demand when applicable,

(2) Shut down idling air compressors.

(3) Where possible, locate air-cooled compressors where room temperature will not exceed 100 degrees F. Utilize heat from compressors to provide space heating in winter and provide ventilation to remove heat from the plant in summer.

(4) Select an air compressor with a pneumatic load-unload feature that, when fully unloaded, consumes approximately 15 percent of the base load horsepower.

(5) Use waste heat from the oil cooler to heat makeup air, or for building space heating in the winter.

(6) When economically justifiable, use multistage compression with intercoolers.

b. After cooler with separator.

(1) Aftercooler selection should be based on degree of drying required downstream of the aftercooler. Final discharge air temperature of the aftercooler will affect dryer sizing and can reduce both initial and operating costs of compressed air dryers.

(2) Duct air from air-cooled aftercoolers to provide space heating in winter and to remove heat from the plant in summer. Pipe coolant water to recycle heat waste.

c. Filters and dryers.

(1) Improve air quality only to the degree required at the point of use. If air quality requirements differ at various points of use, specify appropriate filters or dryers in applicable branch lines.

(2) Accurately determine the dew point required at each point of use. The type and size of dryer selected will affect operating cost. If the dryer must prevent condensation of moisture in air systems, determine lowest temperature to which piping will be exposed and select dryer to achieve a system pressure dew point 20 degrees F below that lowest temperature. If seasonal temperatures vary widely as from freezing to temperate, select a dryer which allows dew point adjustment.

(3) Room air temperatures will affect drying efficiency. If practicable, locate dryers where ambient temperature will not exceed 100 degrees F.

a(4) Select dryer in conjunction with aftercooler so inlet air temperature to the dryer can be as low as feasible. Keep inlet pressure as high as possible. Accurately determine operating temperature and pressure, since even minor changes in either can result in substantial operating costs.

d. Air leakage.

(1) Maximum acceptable air leakage rate for a compressed air system should not exceed 10 percent of the installed system flow rate. Air leaks occur most often at pipe joints, hose connections, and equipment connections; and are usually a result of poor maintenance practices and/or inadequately trained maintenance personnel.

(2) Specification of quality materials and workmanship are a major contribution the designer of a compressed air system can provide for a safe and relatively leakfree air system. In addition, designing the compressed air system with minimum piping and pipe joints, will reduce potential leakage sources.

1-5. Electrical work.

Work will be designed in accordance with TM 5-81 1-2/AFM, 88-9. Chapter 2.

1-6. Foundations.

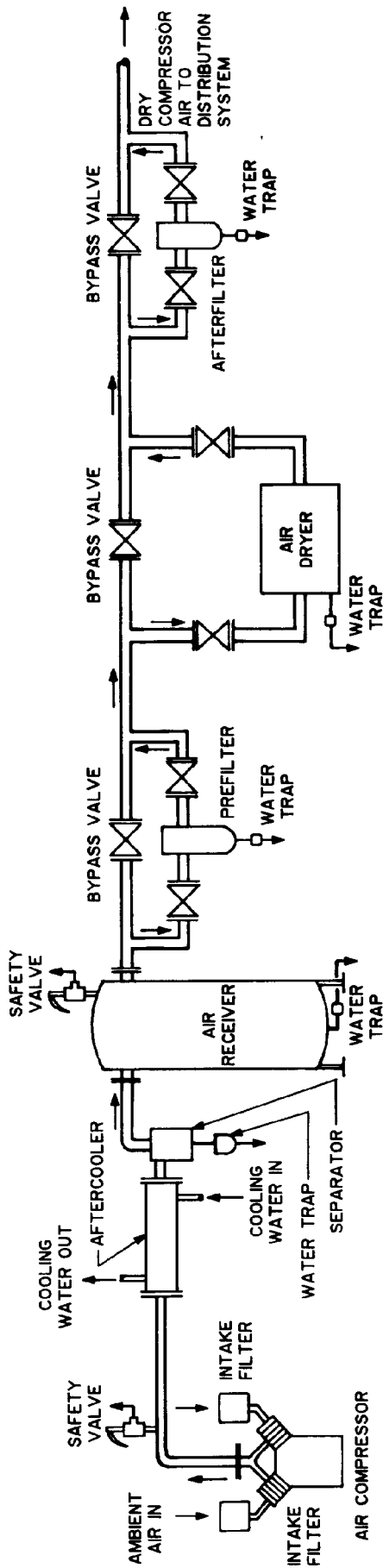


Figure 1-1. Typical compressed air system.

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a. A properly designed and constructed compressor foundation performs the following functions:

(1) Maintains the compressor in alignment and at proper elevation.

(2) Minimizes vibration and prevents its transmission to the building structure.

(3) Provides enough mass to support the compressor's weight plus disturbing forces.

(4) Provides for the installation of sufficiently long foundation bolts to insure good anchorage.

b. Concrete foundations must provide a permanently rigid support for the machinery. Where the foundation is exposed to freezing temperatures, its depth should extend below the frost line. Isolating the foundation from any building footings, walls, or floors will help to prevent vibration from being carried into the building structure. TM 5-805-4/AFM 88-37 should be consulted for the recommended vibration isolation practices. Each machine requires an independent foundation. Operating platforms must be isolated from the machinery foundations. Drawings will be prepared for compressor foundations, and all conditions surrounding the foundation will be made uniform. The foundation should rest entirely on natural rock or entirely on solid earth, but never on a combination of both. If the foundation substructure rests on bedrock, a vibration damping material should be interposed between the substructure and the bedrock. If a foundation or foundation substructure rests on piling, the piling should be covered with a heavy, continuous, concrete mat. Foundation anchor bolts hold the compressor down firmly and prevent it from sliding laterally.

c. Horizontal and vertical reciprocating air compressors will have a spring-mounted concrete inertia base installed on a concrete foundation block. Limit stops will be provided for seismic considerations. For compressor sizes 25 horsepower and larger, it becomes necessary to engage the services of a foundation specialist to:

(1) Test the ability of the soil to carry the load.

(2) Consider the elastic characteristics of the ground on which the foundation rests, since reciprocating machines exert a dynamic loading as well as a static loading on the foundation. The unbalanced forces of the compressor are available from the manufacturer.

(3) Check wet season and dry season soil characteristics (static loading limits and elasticity).

(4) Determine need for piling, either vertical or batter piles (piles driven at an angle at the foundation ends).

d. Rotary machines have considerably less vibration, and may have a spring-mounted structural steel base supported on a concrete foundation block, with limit stops provided for seismic considerations. Some rotary package compressors may be mounted on existing concrete floors, depending on size and manufacturer's recommendations, requiring only lag bolts to keep the machine in place.

e. Chapter 10, Seismic Design for Mechanical and Electrical Elements, of TM 5-809-10/AFM 88-3. Chapter 13

should be consulted for seismic considerations.